

An aerial photograph of the Oroville Dam and Lake Oroville. The dam is a large concrete structure spanning a river. The lake is a deep blue color, and the surrounding landscape is a mix of dry, brownish-yellow earth and green trees. A winding road is visible on the left side of the image. The text is overlaid on the upper right portion of the image.

Oroville FERC Relicensing (Project No. 2100)

Environmental Work Group

July 28, 2004

SP-F10 Task 2C Final Report



Evaluation of the Timing, Magnitude, and Frequency of Water Temperatures and Their Effects on Chinook Salmon Egg and Alevin Survival

SP-F10 Task 2C

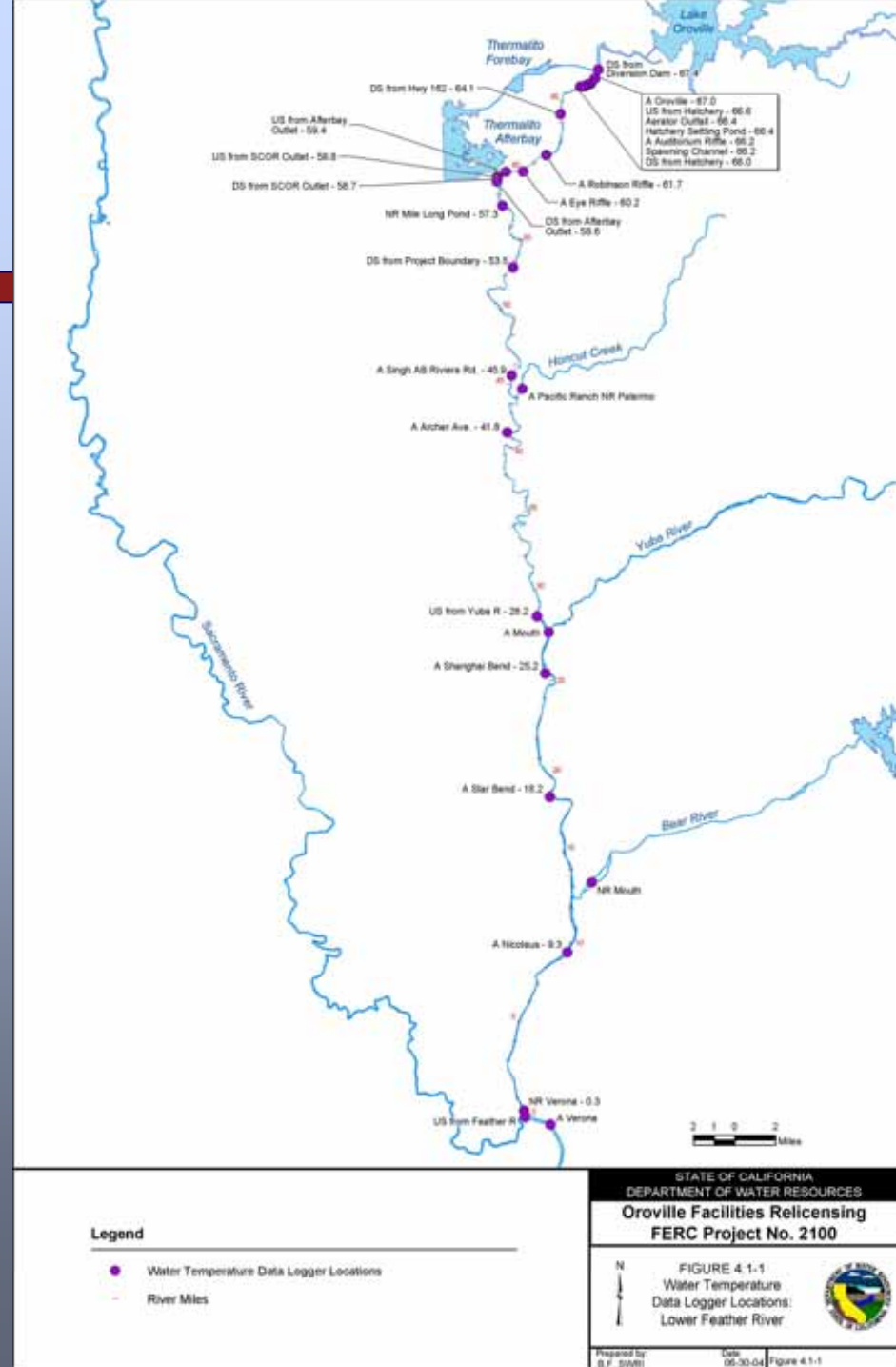


Study Objectives

- ◆ The objective of SP-F10 Task 2C was to evaluate the timing, magnitude, and frequency of water temperatures and their effects on Chinook salmon egg and alevin survival in the lower Feather River.
- ◆ Original Objective and rationale for change
 - ◆ Included water temperature effects on salmonid spawning distribution
 - ◆ Water temperature effects on spawning distribution was included in SP-F10 Task 2B

Introduction Study Area

- ◆ Feather River from the Fish Barrier Dam to confluence with the Sacramento River



Introduction

Operational Constraints

- ◆ **Water Temperature Requirements**
 - ◆ **Hatchery objectives**
 - ◆ **Robinson riffle objectives**
 - ◆ **65°F from June 1 through September 30**
 - ◆ **HFC objectives**

Hatchery Water Temperature Objectives	
Water Temperature	Time Period
52°F	September
51°F	October and November
55°F	December through March
51°F	April through May 15
55°F	May 15 through May 31
56°F	June 1 through June 15
60°F	June 16 through August 15
58°F	August 16 through August 31

Methodology

Study Design

◆ USBR Early Life Stage Mortality Model

◆ History

◆ Model Description

◆ Life Stages

Year	Reach	Date Spawners Arrive	Peak Spawner Arrival Date	In-vivo Egg Mortality	Date Spawning Begins	Date of Spawning Peak	Egg Mortality	Date Eggs Hatch	Alevin Mortality	Emergence Date
2002	LFC	July 2	September 16		July 15	September 29		After 750°F ATU requirement is reached		After 750°F ATU requirement is reached
	HFC	June 6	October 15		June 19	October 28				
2003	LFC	June 29	September 12		July 12	September 25				
	HFC	May 23	October 26		June 5	November 8				

Methodology

Study Design

◆ Model Description

◆ Reach Distributions

	Reach No.	Reach boundaries (RM)	Reach Distribution (%)
			2002 - 2003
LFC	1	Fish Barrier Dam (RM 67.3) – RM 65	27.9
	2	RM 65 – RM 62	38.0
	3	RM 62 – Upstream of Afterbay (RM 59)	15.2
	Total		81.1
HFC	4	Downstream of Afterbay Outlet (RM 59) – RM 55	12.2
	5	RM 55 – Gridley Bridge (RM 51)	6.7
	6	Gridley Bridge (RM 51) – RM 47	0.0
	7	RM 47 – Honcut Creek (RM 44)	0.0
	8	Honcut Creek (RM 44) – Yuba River (RM 27.7)	0.0
	9	Yuba River (RM 27.7) – Mouth	0.0
	Total		12.2

Methodology

Study Design

◆ Model Description

◆ Inputs

- ◆ Pre-spawning and spawning distributions,
- ◆ Mortality rates,
- ◆ Water temperature

◆ Output

- ◆ Location

Known Variables/ Values	
Distributions	PSD (pre-spawning)
	SD (spawning)
	RD (reach)
Mortality Criteria	PSC (pre-spawning)
	EC (egg)
	FC (pre-emergent fry)
Water Temperature Data	
Computed Variables/ Values	
Distributions	AD (adult)
	ESD (spawned eggs)
	ED (egg)
	FD (pre-emergent fry)
Development Variables	EFRY (emergent fry)
	FRY (pre-emergent fry)
Kills (Losses)	AKIL (eggs in adults)
	EKIL (egg)
	FKIL (pre-emergent fry)
Mortalities	EM (egg)
	PSM (pre-spawning)
	FM (pre-emergent fry)

Methodology

Study Design

- ◆ **Model Description**

- ◆ **Modifications to the model for this analysis**

- ◆ Temporal pre-spawning and spawning distributions
- ◆ Water temperatures

- ◆ **Rationale – carcass survey vs USBR model**

Carcass survey	LFC	HFC
2000	10/20/00	11/22/00
2001	11/01/01	11/15/00
2002	10/26/02	11/22/02
2003	10/24/03	11/29/03
USBR Spawning	11/18/02	12/02/02

Methodology

Data Collection

- ◆ **Carcass survey**
 - ◆ **September 3, 2002 through December 19, 2002**
- ◆ **Daily mean water temperatures**
 - ◆ **February 10, 2002 through April 15, 2003**

Methodology

Data Collection

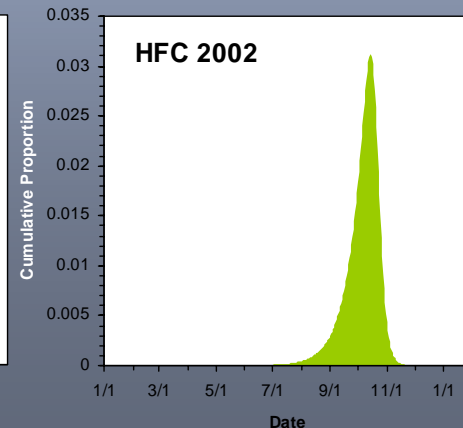
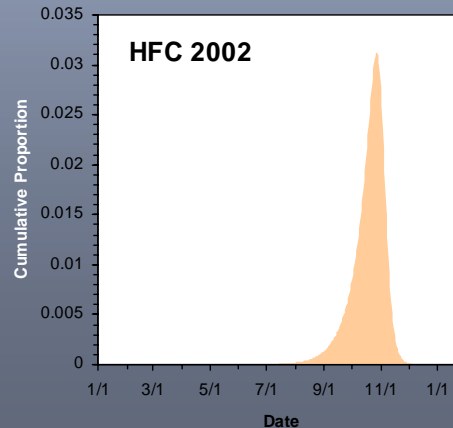
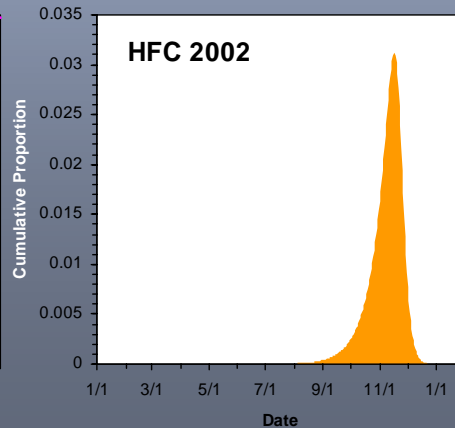
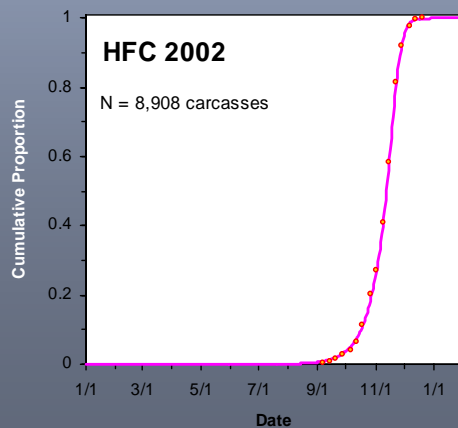
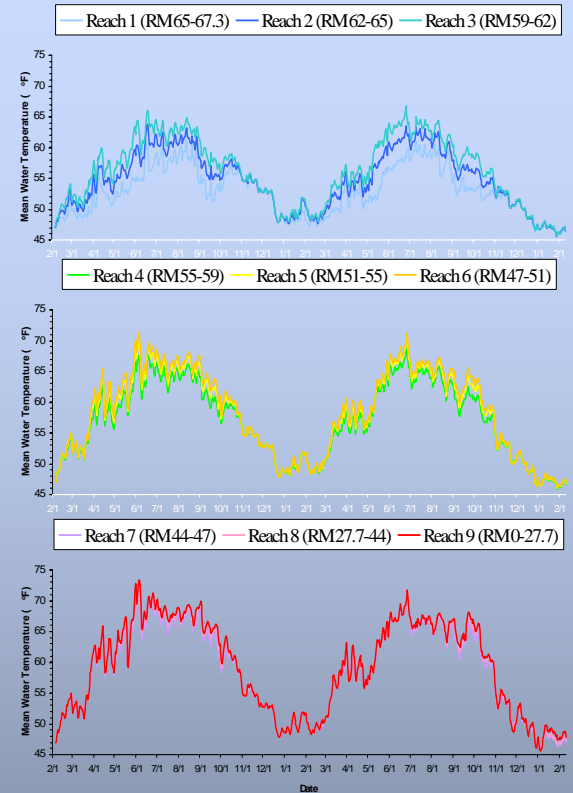
◆ Data manipulation

◆ Carcass survey data

- ◆ Calculate cumulative carcass distribution
- ◆ Calculate daily distribution of carcasses
- ◆ Calculate daily distribution of spawners
- ◆ Calculate daily distribution of pre-spawners

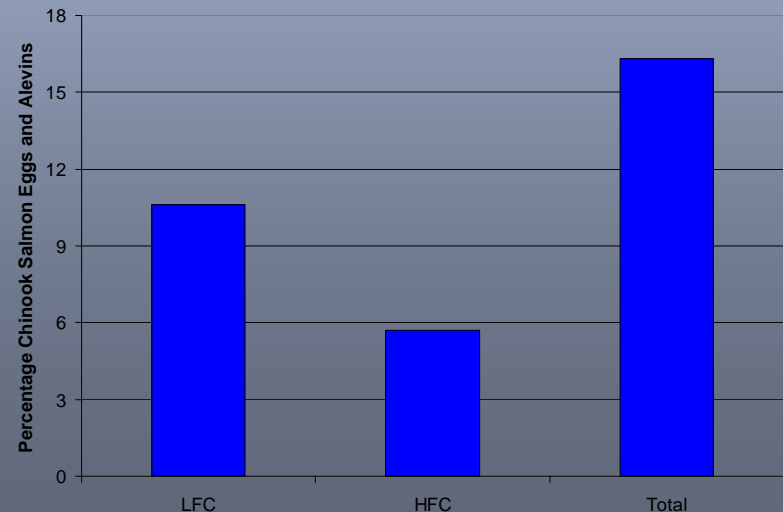
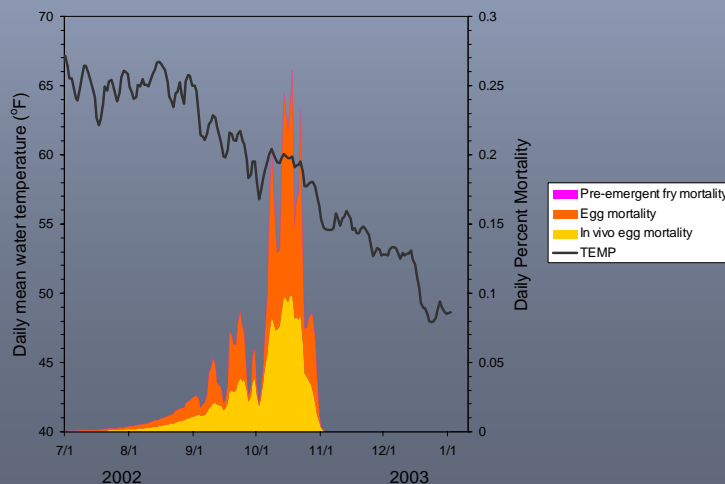
◆ Water temperature data

- ◆ Estimate daily mean water temperature by reach



Results

- ◆ **16.3% of Chinook salmon eggs and alevins were estimated to have been lost in the lower Feather River during the 2002/2003 spawning and egg incubation season.**
 - ◆ **10.6% of the mortality occurred in the LFC**
 - ◆ **5.7% of the mortality occurred in the HFC**



Results

- ◆ The total water temperature induced mortality (16.3%) in the lower Feather River during the 2002/2003 spawning and egg incubation period was composed of:
 - ◆ 7.9% in-vivo egg mortality
 - ◆ 5.2% in the LFC and 2.7% in the HFC
 - ◆ 8.4% in-redd egg mortality
 - ◆ 5.4% in the LFC and 3% in the HFC
 - ◆ 0.033% alevin mortality
 - ◆ 0.033% in the LFC and 0.0% in the HFC

Analyses

◆ Comparison to other rivers

- ◆ Lower Feather River Chinook salmon (this analysis)– 16.3%
- ◆ Lower American River Fall-run Chinook salmon - 14.5%
- ◆ Sacramento River
 - ◆ Spring-run Chinook salmon
 - ◆ Balls Ferry – 20.8%
 - ◆ Jelly's Bend – 26.5%
 - ◆ Fall-run Chinook salmon
 - ◆ 13.2%